

**ENERGY FACILITY SITE EVALUATION COUNCIL
STATE OF WASHINGTON**

IN THE MATTER OF APPLICATION
NO. 96-1

OLYMPIC PIPE LINE COMPANY

CROSS CASCADE PIPE LINE
PROJECT

APPLICATION NO. 96-1

PREFILED TESTIMONY OF
EDWARD P. KLUCKING, PH.D.
EXHIBIT EPK-T

ISSUE: PALEONTOLOGICAL
RESOURCES AT GINKGO
PETRIFIED FOREST STATE PARK
SPONSOR: WASHINGTON STATE
PARKS AND RECREATION
COMMISSION

Q. Please provide your name and business address to the Council.

A. Edward P. Klucking
Professor of Biological Sciences, Emeritus
Central Washington University
Ellensburg, Washington 98926

Q. Please summarize your employment and educational background.

A. I am a retired Central Washington University Professor currently doing research work at Central on leaf venation patterns. I taught geology and paleontology at Central from 1960 until 1994.

My education consists of a B.A. degree from Macalester College in St. Paul, Minnesota with a Geology Major and a Botany Minor. My graduate education resulted in an M.A. and a Ph.D degree from the University of California at Berkeley, both in Paleontology with specialization in Paleobotany.

Q. Generally, what is the subject of your testimony?

A. I will discuss the nature, significance, and value of the fossil resources in the Ginkgo Petrified Forest State Park, and the impact that construction of the proposed Cross Cascade Pipeline through the park would have on these resources.

1 **Q. How are you familiar with the Ginkgo Petrified Forest State Park and the**
2 **paleontological resources within the park.**

3 A. I became very familiar with the park and its paleontological resources during the
4 approximately thirty-four years that I taught at Central. I replaced Professor George Beck
5 when he retired in 1960 from what was then called Central Washington State College
6 (now Central Washington University). I became the Geologist-Paleontologist Professor
7 at Central.

8 While George Beck was a Professor at Central, he discovered petrified wood in
9 the Vantage area in 1931. After several years of doing extensive exploration and
10 collecting he realized he was dealing with a very rich accumulation of fossil woods.
11 Through his efforts the Ginkgo Petrified Forest was designated as a State Park in 1935.
12 The fossil wood collection belonged to the College, and when I replaced Professor Beck,
13 curation of the collection was part of my job. Professor Beck's slides, papers, field notes,
14 and publications were entrusted to me at that time. Unfortunately, Professor Beck passed
15 on some years ago.

16 My function at Central, in addition to teaching, was to build up the fossil
17 collections. To do this, I led regular field trips to teach students how to find, collect, and
18 identify fossils. (Since the College already had a good fossil wood collection, most of the
19 field trips were used to build a fossil leaf and invertebrate collection.) Over my years at
20 Central, I have extensively reviewed Professor Beck's written documentation of the
21 petrified wood resources at Ginkgo, and have found his field notes remarkably accurate.

22 In 1965, the Ginkgo Petrified Forest was registered as a national natural landmark.
23 Professor Beck was present at the dedication and I gave a short speech emphasizing the
24 scientific significance of the forest, and of George Beck's contributions toward making
25 this significance known.

26 **Q. What is the Ginkgo Petrified Forest?**

1 A. The Ginkgo Petrified Forest is an accumulation of fallen trees that have become stony by
2 the replacement of their cells with dissolved minerals. The replacement of the cells of
3 once living organisms with dissolved minerals is called petrification. That is why the
4 fossil woods are referred to as petrified woods. The process is very slow and woods cells
5 are frequently not completely replaced. This makes it possible to examine the actual cells
6 of those ancient woods by dissolving the petrified wood in an acid which will not
7 dissolve cellulose wood cell walls.

8 Silica is the mineral which has replaced the cells of the logs in the Ginkgo
9 Petrified Forest. Silica makes up all or most of minerals like quartz, flint, agate, opal,
10 sand and many others. It is also used to make glass. The source of the silica petrifying
11 these logs was lava. Lava, or molten rock, emerges at temperatures anywhere from 1500
12 to 2200 degrees centigrade. Its cools as it moves across the surface eventually solidifying
13 at 500 to 700 degrees centigrade. Solidified lava is called basalt. The terms lava flows
14 and basalt flows are often used interchangeably. Different minerals in the lava mixture
15 form crystals at different temperatures. Silica crystalizes at temperatures between 500-
16 800 degrees centigrade. Thus the lava is enriched in silica just before solidifying.

17 There are around 50 basalt flows in Central Washington forming the Columbia
18 Plateau. These flows were emplaced over a 9 million year span of time extending from
19 20 million to 11 million years ago. Within the Park area the Ginkgo flow is the best
20 known flow because of the number of fossil woods it contains.

21 The Ginkgo flow is approximately 190 feet thick and divided in subunits. The
22 lowermost unit or basal portion of the flow is a pillow palagonite complex. Pillows are
23 roughly circular or rope-like structures which are formed when lava is suddenly cooled
24 upon flowing into standing water. It's like the balls that are formed when a hot liquid
25 candy mixture is dripped into cold water to see if the candy is ready to set. The granular
26 palagonite is mustard yellow in color and is formed through the interaction of the lava

1 and lake or pond bottom sediments. It is in the palagonite, between the pillows, that most
2 of the logs were entombed and then petrified. The pillow-palagonite unit is 125 feet thick
3 in some places, absent or nearly so in others but apparently quite widespread.

4 The Ginkgo flow rests on the Vantage sandstone-siltstone beds of an apparent
5 lake. Locally the Vantage sandstone contains a fossil leaf flora. The Ginkgo flow is rich
6 in the number of petrified logs that have been uncovered, particularly within the Ginkgo
7 Petrified Forest State Park; several thousand specimens of petrified wood were collected
8 from the ginkgo flow. Through Professor Beck's work at Central, 200 different types of
9 wood have been recognized and 75 genera of these 200 types have been identified.
10 Professor Beck estimated that there may be as many as 10,000 logs still uncovered within
11 the Park boundaries.

12 **Q. What scientific work has been done to document the petrified wood resources at**
13 **Ginkgo?**

14 A. Nearly all of the published works consisting of the descriptions of identified wood
15 specimens, abundance and nature of origin were done by Professor Beck. These reports
16 were published in periodicals like the Mineralogist, Mineral Notes and News, Geology
17 News Letters from Oregon, and Northwest Science. Most of these articles covered 1-3
18 pages or less per issue. The most comprehensive descriptions were "tertiary coniferous
19 woods of western North America" in two issues of Northwest Science in 1945 and the six
20 issues of "Fossil Woods of the Far West" Northwest Mineral News in 1955 and 1956.
21 These papers dealt with the hardwoods of the petrified forests. The other main source for
22 the documentation of the petrified woods of ginkgo are George Beck's field notes, which
23 are quite informative, are replete with map sketches, and, as I noted, are remarkably
24 accurate. Professor Beck also mimeographed a 1-2 page newsletter which included
25 descriptions of fossil woods and prints of each wood section described. These were
26 subscribed to by rock hounds mainly in Washington and Oregon.

1 In addition, during my thirty-four years at Central, I continued to work with
2 Professor Beck's collection to further document the number and species of petrified trees
3 within the forest. For example, I directed numerous undergraduate and some graduate
4 students' work to section, identify, and describe fossil woods from the Ginkgo Petrified
5 Forest. I used the slides prepared by these students to teach extended education classes
6 on how to prepare and identify petrified wood specimens.

7 **Q. What, in your opinion, is the significance of the Ginkgo Petrified Forest, from a**
8 **paleontological perspective?**

9 A. The presence of fossil logs are easily detected because of their occurrence in the pillow
10 palagonites found at the base of the ginkgo flow. The mustard yellow color of the
11 palagonite is an easily seen marker. The palagonites were formed in water and saved the
12 woods that were present from being destroyed. The basalt portion of the flow, above the
13 pillow palagonite, sealed off bacteria and other organisms from decaying the wood and
14 furnished silica to protect and replace the wood cells through time so that an excellent
15 reproduction of the original was obtained.

16 The Ginkgo Petrified Forest is the only petrified forest that has been preserved in
17 a lava flow. Other petrified forests are buried in ash or covered by sediments. Nowhere
18 is there a greater concentration of petrified logs than the Vantage area. Since discovery,
19 several hundred logs have been uncovered and estimates on the number of logs still
20 buried are in the thousands. This is based on the concentration of logs in known sites and
21 the amount of still unexplored outcroppings of the ginkgo flow.

22 Additionally, nowhere has a greater number of different types of petrified woods
23 been found in a single area than in the Ginkgo Petrified Forest. Over 200 types have been
24 recognized and the names of 75 genera and species designated. Most of the other
25 petrified forests of the world have at best 10 to 20 different types. There is a greater
26 diversity of trees from different ecological areas found together here than in any other

1 petrified forest in the world. There are native and exotic species, upland and lowland
2 species, dryland and swamp, and temperate and warm temperate species represented here.

3 Indeed, it is the diversity of species that makes the Ginkgo Petrified Forest so
4 scientifically interesting. Since approximately 90% of the thousands of wood specimens
5 examined are assignable to 15 genera, mostly upland forms like Douglas fir, hemlock or
6 fir, the claim has been made that the woods of this forest were emplaced by a mudslide,
7 and covered by a lake which was in turn covered by a lava flow. The presence of sweet
8 gums, laurels, and ginkgo indicates warmer lowland conditions, and that of swamp
9 cypress and tupelo indicates these trees were living where they were preserved. These
10 differences of opinion can only be resolved by collection and identification of more fossil
11 woods. Since the Ginkgo flow has been shown to have the greatest concentration of
12 petrified logs, this flow should be more thoroughly examined. Understanding the
13 petrified woods within the Ginkgo flow may well prove to be an important step in our
14 understanding of the geologic history of Washington State.

15 **Q. Are you familiar with the proposal by the Applicant in this proceeding, Olympic**
16 **Pipeline Company, to construct a petroleum pipeline through the park?**

17 A. Yes. I have read portions of Olympic Pipeline Company's Revised Easement Application
18 to the Washington State Parks and Recreation Commission, including sections describing
19 the project, the general construction methodology and restoration, and the specific
20 construction methodology and restoration relating to the proposed pipeline route through
21 Ginkgo. I was particularly interested in portions of the application discussing the
22 trenching and possible blasting techniques, as well as the use of heavy equipment
23 anticipated by the applicant. Additionally, I studied maps showing the locations of
24 petrified woods from Professor Beck's field notes and compared them to the route of the
25 proposed pipeline. I have attached as Exhibit EPK-1 to my testimony a copy of the map
26 from Professor Beck's field notes which shows the clusters of petrified logs discovered in

1 the park. I also examined a geological map showing the outcropping of the Vantage
2 sandstone on which the Ginkgo flow rests, and compared it to the map showing the fossil
3 sites. Finally, I walked with Olympic Pipeline Company and Parks staff, and a DNR
4 geologist, over the portion of the proposed route which would result in the greatest
5 impact on the fossil resource.

6 **Q. In your opinion, how would construction of the pipeline impact the paleontological**
7 **resources at Ginkgo?**

8 A. The greatest concentration of petrified woods in the Ginkgo Petrified Forest occurs along
9 the slopes of Schnebly Coulee, in the Vantage, Hells Kitchen, and Whiskey Dick area,
10 and along the slopes of the Rye Grass Coulee. Most of the woods in these areas are
11 preserved in the Ginkgo flow. The proposed pipeline route will run through the fossil
12 rich, pillow palagonite portion of this flow for about 2 miles or more on top of a ridge in
13 Schnebly Coulee and just above woods found in slides or slumps along Rye Grass
14 Coulee.

15 The use of the trencher and heavy equipment would shatter a large amount of
16 fossil wood. Cryptocrystalline silica, which is what the fossil woods are made of, has a
17 hardness of 6 on a scale of 1 to 10 with diamond being a 10. Though it is hard, it is glass-
18 like and actually rather brittle. The trencher would shatter most of the fossil wood it
19 encountered, and if blasting were to be used where the trencher was ineffective,
20 considerably more of the wood would be destroyed.

21 The procedure of removing the topsoil and grading as well as the trenching which
22 would follow would result in a considerable mixing of useable specimens. It would make
23 it impossible to make an accurate count of the numerical representation of the various
24 species of logs present. This in turn would affect climatic and ecological interpretations.
25 For instance, if the log of a laurel tree, an indicator of warm climates, were fragmented
26 into hundreds of parts and mixed with others so that one could not be certain if one or

1 many laurel logs were present, it would be impossible to state whether the laurel speci-
2 mens represented a major part of the forest or a holdover from a different type of forest.

3 In addition to destruction and physical damage which would result to the fossil
4 wood resource by the emplacement of a pipeline along its proposed route in Schnebly
5 Coulee and Rye Grass Coulee, a great amount of fossil wood will be exposed to
6 poaching. When I-82 to Yakima and I-90 through Rye Grass Coulee were constructed,
7 exposed logs were taken away by the pickup loads, most for display in yards or gardens.
8 Exposure of large pieces of logs in such remote areas as the proposed pipeline would
9 traverse would invite poaching, particularly if adequate security were not provided.
10 Petrified wood is valuable, with uncut or unpolished wood selling for \$2.00 to \$4.00 a
11 pound and logs in the round bringing about \$400 to \$1,000 a foot.

12 **Q. Is there anything Olympic Pipeline Company can or should be required to do to**
13 **reduce these potential impacts?**

14 A. The damage that the pipeline construction will cause to the fossil resources cannot, in my
15 opinion, be eliminated, and will only be slightly reduced if blasting is not used. Petrified
16 wood that is shattered by the trencher cannot be replaced, and it is doubtful if the
17 remaining fragments will be useful for scientific purposes. Damage and destruction of
18 petrified wood resources could be greatly reduced or perhaps eliminated only if the route
19 of the proposed pipeline were modified to avoid trenching in the pillow palagonite beds
20 in the basal part of the Ginkgo flow. This is the flow of highest petrified wood
21 concentration in the Park.

22 Poaching of uncovered woods could be greatly reduced if,

- 23 A) a park representative is on the site during the entire construction and restoration
24 operation;
25 B) night security is provided at the location of the trench until uncovered wood
26 specimens have been secured; and

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C) all uncovered wood specimens are removed from the site each day before dark
and taken to the Ginkgo Petrified Forest Interpretive Center for safekeeping.
DATED this _____ day of February, 1999.

EDWARD P. KLUCKING, Ph.D